Survey of the Fish Assemblages of St. Lawrence Islands National Park in 2005

N.E. Mandrak, J. Barnucz, and D. Marson

Great Lakes Laboratory for Fisheries and Aquatic Sciences
Department of Fisheries and Oceans Canada
P.O. Box 5050, 867 Lakeshore Road
Burlington, Ontario L7R 4A6A

2006

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2777

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 1426 - 1550 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports manuscrits sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 900 de cette série ont été publiés à titre de Manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme Manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de Rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de Rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

2007-05565/

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2777

2006

SURVEY OF THE FISH ASSEMBLAGES OF ST. LAWRENCE ISLANDS NATIONAL PARK IN 2005

by

N.E. Mandrak, J. Barnucz and D. Marson

Great Lakes Laboratory for Fisheries and Aquatic Sciences
Department of Fisheries and Oceans Canada
P.O. Box 5050, 867 Lakeshore Road
Burlington, Ontario
L7R 4A6

© Her Majesty the Queen in Right of Canada, 2006.
Cat. No. Fs 97-4/2777E ISSN 0706-6473

Correct citation for this publication:

Mandrak, N.E., J. Barnucz, G.J. Velema, and D. Marson. 2006. Survey of the fish assemblages of St. Lawrence Islands National Park in 2005. Can. Manuscr. Rep. Fish. Aquat. Sci. 2777: v + 17 pp.

TABLE OF CONTENTS

TABLE OF CONTENTS III
ABSTRACT V
RÉSUMÉ V
1.0 INTRODUCTION 1
2.0 METHODS 1
2.1 SITE SELECTION 1
2.2 ELECTROFISHING SAMPLING 1
2.3 FYKE NET SAMPLING 5
2.4 MINNOW TRAP SAMPLING 5
2.5 BAG SEINING 5
2.6 SPECIES AT RISK 5
2.7 HABITAT DATA COLLECTION 5
3.0 RESULTS 6
3.1 FYKE NET SAMPLING 6
3.2 BOAT ELECTROFISHING 7
3.3 BAG SEINING 7
3.4 SPECIES AT RISK 8
3.5 HABITAT DATA 8
4.0 DISCUSSION 10
5.0 ACKNOWLEDGMENTS 11
6.0 LITERATURE CITED 12

LIST OF FIGURES

Figure 1. Sites sampled in St. Lawrence Islands National Park sites (6 to 19) in 2005.....3
Figure 2. Sites sampled in Big Rideau Lake (sites 1 to 5) in 2005.....4

LIST OF TABLES

Table 1. Summary of catch data for St. Lawrence Islands National Park sites sampled in 2005.....6
Table 2. Summary of species detection variation between boat electrofishing (BEF), fyke netting (FN), and seining (SN) sites in the St. Lawrence Islands National Park in 2005.....6
Table 3. Summary of sampling effort at St. Lawrence Islands National Park sites in 2005.....7
Table 4. Summary of seining effort in Big Rideau Lake sites and the St. Lawrence Islands sites during the 2005 sampling.....7
Table 5. Summary of species captured at St. Lawrence Islands National Park in 2005...9

LIST OF APPENDICES

Appendix 1. Site descriptions for the St. Lawrence Islands National Park sampling in 2005.....13
Appendix 2. Summary of sampling effort by site for St. Lawrence Islands National Park in 2005.....14
Appendix 3: Summary of habitat data for St. Lawrence Islands National Park sampling in 2005.....15
Appendix 4a: Summary of species collected by site during St. Lawrence Islands National Park sampling (sites 1-10). Scientific and common names according to Nelson *et al.* (2004).....16
Appendix 4b: Summary of species collected by site during St. Lawrence Islands National Park sampling (sites 11-19). Scientific and common names according to Nelson *et al.* (2004).....17

ABSTRACT

In 2005, a survey of fish assemblages in portions of the St. Lawrence Islands National Park, and the Rideau Waterway was conducted by Fisheries and Oceans Canada (DFO) and members of the park staff. A total of 19 sites in the St. Lawrence River and Big Rideau Lake were sampled using boat electrofishing, bag seining, fyke netting and minnow traps. A total of 1924 fishes were captured, representing 26 species, including three species at risk (bridle shiner, grass pickerel and pugnose shiner). During the 2005 sampling, boat electrofishing caught the highest number of species, relative to seining and fyke netting. Of the 26 species captured, 24 species were caught by boat electrofishing (including seven species exclusively caught electrofishing), 18 species were caught seining (including two species exclusively caught seining), 8 species were caught fyke netting (none were exclusive to fyke netting), and no fish were captured in the minnow traps. Seining caught the greatest number of species at risk.

RÉSUMÉ

En 2005, une étude sur les assemblages de poissons dans des parties du parc national des îles-du-Saint-Laurent, et la voie d'eau Rideau a été menée par Pêches et Océans Canada (MPO) et des membres du personnel du parc. Un total de 19 sites dans le fleuve Saint-Laurent et du lac Big Rideau ont été échantillonnés en utilisant la pêche électrique en bateau, la senne en sac, le verveux et les nasses à vairon. Un total de 1 924 poissons ont été capturés, représentant 26 espèces, y compris trois espèces en péril (le brochet vermiculé, le mené camus et le mené d'herbe). Au cours de l'échantillonnage de 2005, la pêche électrique en bateau a permis de capturer le plus grand nombre d'espèces par rapport à la senne et au verveux. Des 26 espèces capturées, 24 espèces ont été capturées par la pêche électrique en bateau (y compris sept espèces prises exclusivement par la pêche électrique), 18 espèces ont été prises par la senne (y compris deux espèces exclusivement prises par la senne), 8 espèces ont été prises par verveux (aucun échantillonnage n'était exclusivement par verveux), et aucun poisson n'a été capturé dans les nasses à vairon. La senne a permis de capturer le plus grand nombre d'espèces en péril.

1.0 INTRODUCTION

The St. Lawrence Islands National Park is located between Brockville and Gananoque in eastern Ontario (Figure 1). In 2005, Fisheries and Oceans Canada (DFO), and St. Lawrence Islands National Park staff conducted a fish survey in the Park: 1) to introduce Park staff to proper fish sampling techniques using a variety of sampling gear; 2) to instruct Park staff on fish identification; 3) to survey the fish assemblage of St. Lawrence Islands National Park and the Rideau Waterway; and, 4) to determine the current status of fish species at risk within the Park. Both active and passive gear types were used during the survey. Active gear included boat electrofishing and seining, and the passive gear included fyke nets and minnow traps. Sampling took place on June 21 and 22, 2005. Sampling in the Park occurred mainly on the shoreline of Grenadier Island, adjacent to Mallorytown Landing. Sampling also took place in Big Rideau Lake, near Smiths Falls, Ontario.

2.0 METHODS

2.1 SITE SELECTION

The sampling of the St. Lawrence Islands National Park was primarily focussed on littoral habitat. Site selection beyond this criterion was based on the recommendation of the St. Lawrence Islands National Park staff. Areas thought to contain species at risk, based on Park staff experience, were targeted for sampling. Sites 1-5 were located on Big Rideau Lake (Figure 1, Appendix 1), and the remaining sites, 6-19, were located within the St. Lawrence River (Figure 2, Appendix 1).

2.2 ELECTROFISHING SAMPLING

The electrofishing portion of the sampling was conducted by the DFO crew using a 6.35 m Model SR-20 Smith-Root electrofishing boat equipped with a Model 7.5 kW Smith-Root generator, a 7.5 GPP control box, three kick plates and dual foot pedals. Each transect was sampled twice; at the end of each transect the power was shut down, the boat was turned around, and sampling continued along the transect in the opposite direction until the initial start location was once again reached. A standard power output of 2000-3000 watts was maintained along the entire transect. Each transect was approximately 400 m in length, and was sampled for approximately 800 seconds. Sampling data recorded at each site included capture method, sampling effort,

electrofishing settings, and a description of the sampling equipment. Two netters retrieved the stunned fishes as they appeared, and all fishes were transferred into a live-well within the boat. The fishes were identified, tallied, and discrete length measurements of minimum and maximum lengths were recorded for all species captured. Although most fishes were released, voucher specimens of each species were preserved in 10% formalin for lab verification.

Figure 1. Sites sampled in St. Lawrence Islands National Park (sites 6 to 19) in 2005. Numbers on map correspond to site codes in Appendix 1.

Figure 2. Sites sampled in Big Rideau Lake (sites 1 to 5) in 2005. Numbers on the map correspond to the site codes in Appendix 1.

2.3 FYKE NET SAMPLING

The fyke nets were set perpendicular to shore in close proximity to areas that were sampled by bag seining. The fyke nets were set, left overnight, and fished the following day (approximately 24 h sets). The effort was recorded as the difference between the Start Time (the time the net was set) and Stop Time (the time of retrieval). Fishes were identified, counted and released. Minimum and maximum lengths were recorded for each of the species identified. Voucher specimens of each species were preserved in 10% formalin for lab verification.

2.4 MINNOW TRAP SAMPLING

Two minnow traps were set in conjunction with each of the fyke net sets. The minnow traps were set along the outside, and to the posterior, of the fyke net wings. The minnow traps were not baited. Sampling of fishes would have followed the protocol outlined in the fyke net sampling; however, no fishes were caught in the minnow traps.

2.5 BAG SEINING

Seining was performed using an 8.5 m bag seine with 6.35 mm square mesh. The number of hauls per site varied from one to five. This variation in haul numbers was due to time constraints, damage to the net (for sites with only a single haul), and the capture of new species within consecutive hauls, as it is protocol to continue seining until no new species are captured (in the case of five hauls at Site 3). Fishes caught were put into buckets corresponding to the haul number (e.g. fishes from the second seine haul were placed into bucket #2), until the seining was completed. Upon completion, the fishes were identified, counted, measured and released. For some of the sites, voucher specimens were preserved in 10% formalin for verification in a laboratory.

2.6 SPECIES AT RISK

Discrete individual length and weight measurements were taken of all species at risk caught during sampling.

2.7 HABITAT DATA COLLECTION

Habitat measurements at each site include: air temperature, water temperature, conductivity, water depth, flow rate, substrate components, aquatic vegetation, riparian

vegetation, floodplain use, bank slope, channel cover, and weather conditions. Habitat data were collected prior to seining and retrieving fyke nets, but after electrofishing.

3.0 RESULTS

3.1 FYKE NET SAMPLING

Two sites were sampled using the fyke net/minnow trap combination. A total of 16 fishes, representing 8 species, were captured at the two sites (all caught in the fyke nets) (Tables 1 and 2). The brown bullhead was the only common species captured between the two sets (Appendix 4b). The species richness differed by only a single species between the two sets, with the fyke net catch at Site 14 containing five species, as compared to the fyke net catch of four species at Site 15 (Table 2, Appendix 4b). The catch at Site 14 also contained a greater number of fishes (n=11) than at Site 15 (n=5) (Tables 1 and 2, Appendix 4b). The mean CPUE was 0.3765 fish/hr; the mean effort was 21.25 hrs; and the total sampling effort was 42.5 hrs (Table 3, Appendix 2).

Table 1. Summary of catch data for St. Lawrence Islands National Park sites sampled in 2005; boat electrofishing (BEF), fyke netting (FN), and seining (SN). BR – Big Rideau Lake sites, STL – St. Lawrence Islands sites.

Fishes Caught	BEF	FN	SN - BR	SN - STL	SN - Total
Total	472	16	174	1262	1436
Mean (per site)	94.4	8	38.4	180.29	119.66
Minimum (per site)	20	5	6	0	0
Maximum (per site)	322	11	105	874	874

Table 2. Summary of species detection variation between boat electrofishing (BEF), fyke netting (FN), and seining (SN) sites in the St. Lawrence Islands National Park in 2005. BR – Big Rideau Lake sites, STL – St. Lawrence Islands sites.

Species Detection	BEF	FN	SN – BR	SN – STL	SN - Total
Species Richness	24	8	9	18	18
Unique Species	7	0	0	2	2
Common Species	17	8	9	16	16
Total Species Richness	**26**				

Table 3. Summary of sampling effort at St. Lawrence Islands National Park sites in 2005. Boat electrofishing (BEF) and fyke netting (FN). See Appendix 2 for raw data.

Sampling Effort	BEF	FN
Mean CPUE (fish/hr)	405.44	0.38
Mean Effort/Site (hr)	0.23	21.25
Total Sampling Effort (hr)	1.16	42.5

3.2 BOAT ELECTROFISHING

Five sites were sampled within the Park using the boat electrofishing unit. A total of 481 fishes, representing 24 species, were captured from all electrofished sites (Tables 1 and 2). The lowest catch (20) was at Site 3, and the highest catch (331) was at Site 4 (Table 1, Appendix 4a). The mean CPUE was 413.17 fish/hr; and, the mean effort per site was 0.233 hrs; the total overall effort was 1.16 hrs (Table 3, Appendix 2).

3.3 BAG SEINING

Twelve sites were sampled using an 8.5 m bag seine. Five sites were sampled in Big Rideau Lake (sites 1-5), and seven sites (sites 6-8, 16-19) were sampled in the St. Lawrence River (Appendix 2). A total of 1436 fishes were captured, representing 18 species (Tables 1 and 2). The lowest catch occurred at Site 17, where no fish were caught, while the highest catch occurred at Site 19 where 874 fishes were caught (Table 1, Appendix 4a, 4b).

The seining in the St. Lawrence River caught 18 species, with two unique species. Nine species, none unique, were captured in Big Rideau Lake (Table 2). Total sampling effort in Big Rideau Lake was 15 hauls over five sites, and total effort for the St. Lawrence was 13 hauls over seven sites (Table 4, Appendix 2). Total fishes caught were 174 in Big Rideau, and 1262 in the St. Lawrence, resulting in a mean of 38.4 fishes per site, and 180.29 fishes per site, respectively (Table 1).

Table 4. Summary of seining effort in Big Rideau Lake sites and the St. Lawrence Islands sites during the 2005 sampling.

Sampling Effort	Big Rideau Lake	St. Lawrence River
Mean CPUE (fish/haul)	11.6	97.08
Mean Effort/site (haul/site)	3	1.9
Total Sampling Effort (hauls)	15	13

3.4 SPECIES AT RISK

Two species at risk, pugnose shiner, Endangered, bridle shiner, Special Concern and grass pickerel, Special Concern, were captured during the 2005 survey (scientific names listed in Appendix 4). Pugnose shiner was captured at three sites, with a total of 256 specimens captured. Of the 256 pugnose shiner specimens captured, 247 were captured in a single haul at Site 19. A total of eight bridle shiners were captured at four sites, one sampled by electrofishing and three by seining. Of the eight bridle shiners captured, five were captured within a single seine haul at Site 19. A total of two grass pickerel were captured at Site 12 by boat electrofishing.

3.5 HABITAT DATA

Four of the five sites located in Big Rideau Lake were primarily free of aquatic macrophytes. Sites 1-4 in Big Rideau Lake all had less than 40% aquatic macrophytes (emergent vegetation represented the only aquatic macrophytes present). Site 5, located directly off the Portland Municipal launch on the southeast shore of Big Rideau Lake, had 40% emergent, 40% submergent, and 20% floating vegetation, and was heavily vegetated in contrast to the other sites in Big Rideau Lake.

Of the sites located in the St. Lawrence River, all but sites 6, 7, 8 and 16 contained greater than 50% macrophyte presence. Sites were dominated by submergent, emergent or slender emergent vegetation.

Table 5. Summary of species captured at St. Lawrence Islands National Park in 2005 boat electrofishing (BEF); fyke netting (FN); and seining (SN). BR – Big Rideau Lake sites, STL – St. Lawrence Islands sites. See Appendix 4 for list of scientific and common names.

Common Name	BEF	FN	SN – BR	SN – STL
banded killifish	3		5	49
black crappie				3
blackchin shiner	26	1		322
bluegill	3	1	88	45
bluntnose minnow	71	1	35	404
bowfin	2	2		
brassy minnow	8			
bridle shiner	1		1	6
brook stickleback	3			19
brown bullhead	51	3		1
central mudminnow	2			
common carp	5			
golden shiner	13	1	4	1
grass pickerel	2			
lamprey sp.	1			
largemouth bass	162		3	4
longnose gar	2			
mimic shiner	1			45
northern pike	4			
pugnose shiner	4			252
pumpkinseed	28	2	14	24
rock bass	6	5	7	18
smallmouth bass	1			1
spotfin shiner	2			41
tessellated darter				2
yellow perch	71		17	24
Species Richness	**24**	**8**	**9**	**18**

4.0 DISCUSSION

During the 2005 sampling, boat electrofishing had the highest success in terms of the number of species caught, relative to seining and fyke netting. Three times the number of species was captured boat electrofishing than fyke netting. Of the 26 species captured, 24 species were caught by boat electrofishing (including seven species exclusively caught electrofishing), 18 species were caught seining (including two species exclusively caught seining), and eight species were caught fyke netting (none exclusive to fyke netting) (Table 2). From the data collected, it appears that boat electrofishing was more effective at catching brassy minnow, central mudminnow, common carp, grass pickerel, longnose gar and northern pike, than either seining or fyke netting. However, seining appears to be more efficient at catching black crappie, blacknose minnow and tessellated darter. These findings highlight the importance of incorporating several sampling methods when attempting to conduct a general survey of species.

Although boat electrofishing sampling did result in the capture of all three species at risk, it only captured a single bridle shiner (Site 9), and only four pugnose shiners (all captured at Site 12). No species at risk were captured using fyke nets, despite being located adjacent to sites where both species at risk were captured. The greatest success in capturing species at risk was achieved by seining. Using this method, 252 pugnose shiners were captured at two sites, and seven bridle shiners were captured at three sites. The capture of species at risk was limited to five sites, with Site 19 accounting for 247 of the pugnose shiners and five bridle shiners, Site 6 accounting for five pugnose shiners and one bridle shiner, sites 5 and 9 both had one bridle shiner, and Site 12 accounted for the remaining four pugnose shiners and the two grass pickerel. With the exception of Site 6 with only 40% emergent vegetation, the species at risk were limited to sites with extensive macrophyte growth. Sites 5, 9, 12 and 19 were all 100% vegetated, with submergent and slender emergent macrophytes dominating the plant types present. This evidence supports the observations in the COSEWIC assessment and status reports on both the grass pickerel and pugnose shiner (Crossman and Holm 2005, Holm and Mandrak 2002), and suggests that future surveys in the St. Lawrence Islands National Park of grass pickerel, pugnose shiner, as well as bridle shiner, should target highly vegetated areas, with an emphasis on areas dominated by submergent and slender emergent vegetation.

Only a single species at risk specimen was captured in the Big Rideau Lake portion of the sampling. Although sampling effort was higher in Big Rideau Lake than in the St. Lawrence Islands, it may prove beneficial to incorporate other sampling techniques in Big Rideau Lake in an effort to locate more species, especially additional species at risk.

Despite 26 species being caught in the St. Lawrence Islands National Park during the 2005 survey, several species including the chestnut lamprey, lake sturgeon (Threatened), and river redhorse (Special Concern), which have been historically documented in the area, were not detected (Mandrak and Crossman 1992, COSEWIC 2004). However, it is possible that with additional sampling effort, and by targeting habitat more suited to their particular needs, these species could be located in future surveys of the Park.

5.0 ACKNOWLEDGMENTS

Funding for this study was provided by the DFO SARCEP Programme. Special thanks to the field crew members C. Bellemore, A. Doolittle, A. Drake, T. Lusk, L. O'Keefe and J. VanWieren.

6.0 LITERATURE CITED

COSEWIC. 2006. Canadian Species at Risk. Available: http://www.cosewic.gc.ca/eng/sct0/sar_2004_11_e.cfm#special. Accessed: May 31, 2006.

Crossman, E.J. and E. Holm. 2005. COSEWIC status report on the grass pickerel *Esox americanus vermiculatus* in Canada, *in* COSEWIC assessment and status report on the grass pickerel *Esox americanus vermiculatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-27 pp.

Holm, E. and N.E. Mandrak. 2002. Update COSEWIC status report on the pugnose shiner *Notropis anogenus* in Canada, *in* COSEWIC assessment and update status report on the pugnose shiner *Notropis anogenus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-15 pp.

Mandrak, N.E. and E.J. Crossman. 1992. A Checklist of Ontario Freshwater Fishes: Annotated with Distribution Maps. Royal Ontario Museum, Toronto, Ontario.

Nelson, J.S., E.J. Crossman, H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society. Special Publications 29, Bethesda Maryland. 386 pp.

Appendix 1. Site descriptions for the St. Lawrence Islands National Park sampling in 2005. Map # corresponds to site numbers on maps in Figure 1 and Figure 2.

# on Map	Field Number	Date	Narrative Locality Description	Start Latitude	Start Longitude
1	STLW05062105001	21/06/2005	Easternmost end of Long Lake, Big Rideau Lake	44.7407	-76.22308
2	STLW05062105002	21/06/2005	Adjacent to Colonel By Island, Big Rideau Lake	44.73578	-76.21919
3	STLW05062105003	21/06/2005	Southwest side of Tar Island, Big Rideau Lake	44.7557	-76.21367
4	STLW05062105004	21/06/2005	NW corner of Colonel By Island, Big Rideau Lake	44.73138	-76.23039
5	STLW05062105005	21/06/2005	Directly off of Portland Municipal launch, Hwy 15, Big Rideau Lake	44.71091	-76.17642
6	STLW05062205001	22/06/2005	East side of Genadier Island, Park side Grenadier East - Hefferman Eating House	44.42341	-75.84412
7	STLW05062205002	22/06/2005	At the Grenadier Central launch /docking ; site located on west bank	44.40221	-75.87525
8	STLW05062205003	22/06/2005	Beach site to the west of docking area	44.4021	-75.87617
9	STLW05210605001	21/06/2005	East end of Grenadier Island; St. Lawrence River	44.43746	-75.84517
10	STLW05210605002	21/06/2005	Northeast Corner of Grenadier Island; St. Lawrence River	44.4363	-75.84606
11	STLW05210605003	21/06/2005	South of Rockport; East end Club Island	44.37286	-75.93177
12	STLW05210605004	21/06/2005	Northeast Corner of Collier Island; small bay/inlet	44.34785	-76.05675
13	STLW05210605005	21/06/2005		44.34407	-76.0629
14	STLW05220605hn001	22/06/2005	South Shore of Indian Island	44.41552	-75.87748
15	STLW05220605hn002	22/06/2005	South shore of Genadier Island	44.41542	-75.8721
16	STLW05220605sn001	22/06/2005	South Shore of Indian Island	44.41541	-75.87767
17	STLW05220605sn002	22/06/2005	North Shore of Square Island, St. Lawrence Islands National Park	44.41735	-75.87397
18	STLW05220605sn003	22/06/2005	North shore of Grenadier Island	44.41568	-75.87253
19	STLW05220605sn004	22/06/2005	North Shore of Thompson's Bay	44.41107	-75.90209

Appendix 2. Summary of sampling effort by site for St. Lawrence Islands National Park in 2005. Map # corresponds to site numbers on maps in Figure 1 and Figure 2.

# on Map	Field Number	Date	Duration	Quantification of Capture Effort	Description of Method
1	STLW05062105001	21/06/2005	3	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
2	STLW05062105002	21/06/2005	3	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
3	STLW05062105003	21/06/2005	5	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
4	STLW05062105004	21/06/2005	3	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
5	STLW05062105005	21/06/2005	1	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
6	STLW05062205001	22/06/2005	3	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
7	STLW05062205002	22/06/2005	2	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
8	STLW05062205003	22/06/2005	4	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
9	STLW05210605001	21/06/2005	562	Seconds	E-fishing Boat, S-Rt 6.1 m, 7.5 GPP, dual boom
10	STLW05210605002	21/06/2005	951	Seconds	E-fishing Boat, S-Rt 6.1 m, 7.5 GPP, dual boom
11	STLW05210605003	21/06/2005	894	Seconds	E-fishing Boat, S-Rt 6.1 m, 7.5 GPP, dual boom
12	STLW05210605004	21/06/2005	1076	Seconds	E-fishing Boat, S-Rt 6.1 m, 7.5 GPP, dual boom
13	STLW05210605005	21/06/2005	708	Seconds	E-fishing Boat, S-Rt 6.1 m, 7.5 GPP, dual boom
14	STLW05220605hn001	22/06/2005	21	Hours	Fyke net, and 2 minnow traps
15	STLW05220605hn002	22/06/2005	21.5	Hours	Fyke net, and 2 minnow traps
16	STLW05220605sn001	22/06/2005	1	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
17	STLW05220605sn002	22/06/2005	1	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
18	STLW05220605sn003	22/06/2005	1	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)
19	STLW05220605sn004	22/06/2005	1	Haul	Bag Seine, 6.35mm mesh, Length - 8.5 metres, (25 ft)

Appendix 3. Summary of habitat data for St. Lawrence Islands National Park sampling in 2005. Map # corresponds to site numbers on maps in Figure 1 and Figure 2.

# on Map	Air Temp	Water Temp	Cond (µS)	Secchi Depth (m)	Aquatic Veg Type1	Aquatic Veg 1 (%)	Aquatic Veg Type2	Aquatic Veg 2 (%)	Aquatic Veg Type3	Aquatic Veg 3 (%)	Max Depth (m)	Flow Rate
1	22.7	20		1.2+	Emergent	5	None	95			1.2	None
2	23.6	20.6		1.2+	Emergent	40	None	60			1.1	None
3	23.8	20.6		1.2+	Emergent	5	None	95			1.2	None
4	25.7			1.2+	Emergent	20	None	80			1.3	None
5	25.6	23			Submergent	40	Slender Emergent	40	Floating	20	1.5	None
6	17.5	17		1.2+	Emergent	40	None	60			0.9	None
7		18.2		1.2+	Submergent	30	None	70			1.3	None
8	21.2	19.2			Submergent	5	None	95			0.65	None
9	24	17.7	330	2+	Slender Emergent	80	Floating	10	Submergent	10	1.5	
10	26	18	300	2+	Emergent	60	None	40			2	None
11	27	19	300	2+	Submergent	60	None	40			2	None
12	27.8	22	350	2+	Submergent	60	Floating	20	Emergent	20	1.5	None
13					Emergent	60	None	40			2	Medium
14					Emergent	40	Submergent	20	None	40		
15					Emergent	50	Submergent	25	Floating	25	1	None
16	23.6	20	300	2+	Emergent	30	None	70			1.3	None
17	24	20	300	2+	Slender Emergent	40	Floating	20	None	40	1.3	None
18	21.2	21	300	2+	Slender Emergent	70	Submergent	30				
19			300	2+	Submergent	80	Slender Emergent	20			1.2	None

Appendix 4a. Summary of species collected by site during St. Lawrence Islands National Park sampling (sites 1-10). Scientific and common names according to Nelson *et al.* (2004)

Common Name	Scientific Name	Total	Big Rideau Sites					St. Lawrence Islands Sites				
			1	2	3	4	5	6	7	8	9	10
banded killifish	*Fundulus diaphanus*	**57**		2	1	1	1	2		3	1	
black crappie	*Pomoxis nigromaculatus*	**3**										
blackchin shiner	*Notropis heterodon*	**349**						14			5	
bluegill	*Lepomis macrochirus*	**137**			19		69					
bluntnose minnow	*Pimephales notatus*	**511**	9	3	17	6		30	28	35	42	3
bowfin	*Amia calva*	**4**										
brassy minnow	*Hybognathus hankinsoni*	**8**										
bridle shiner	*Notropis bifrenatus*	**10**					1	1			3	
brook stickleback	*Labidesthes sicculus*	**22**										
brown bullhead	*Ameiurus nebulosus*	**55**									10	10
central mudminnow	*Umbra limi*	**2**										2
common carp	*Cyprinus carpio*	**5**										3
golden shiner	*Notemigonus crysoleucas*	**19**					4				3	
grass pickerel	*Esox americanus vermiculatus*	**2**										
lamprey sp.	*Petromyzontidae* sp.	**1**										1
largemouth bass	*Micropterus salmoides*	**169**		1	1		1				1	
longnose gar	*Lepisosteus osseus*	**2**										2
mimic shiner	*Notropis volucellus*	**46**							6	39	1	
northern pike	*Esox lucius*	**4**										2
pugnose shiner	*Notropis anogenus*	**256**						5				
pumpkinseed	*Lepomis gibbosus*	**68**			1	1	12		10	3	2	
rock bass	*Ambloplites rupestris*	**36**	1		1	1	4	1	2	1		
smallmouth bass	*Micropterus dolomieu*	**2**							1			
spotfin shiner	*Cyprinella spiloptera*	**43**							33	8	1	1
tessellated darter	*Etheostoma olmstedi*	**2**							1	1		
unidentified minnow	Cyprinidae	**1**						1				
yellow perch	*Perca flavescens*	**112**	1			3	13	7	1	5	11	3
Total		**1926**	**11**	**6**	**40**	**12**	**105**	**61**	**82**	**95**	**80**	**27**

Appendix 4b. Summary of species collected by site during St. Lawrence Islands National Park sampling (sites 11-19). Scientific and common names according to Nelson *et al.* (2004).

Common Name	Scientific Name	Total	St. Lawrence Islands Sites								
			11	12	13	14	15	16	17	18	19
banded killifish	*Fundulus diaphanus*	**57**		2				1			43
black crappie	*Pomoxis nigromaculatus*	**3**									3
blackchin shiner	*Notropis heterodon*	**349**		21		1					308
bluegill	*Lepomis macrochirus*	**137**		3			1				45
bluntnose minnow	*Pimephales notatus*	**511**		25	1	1		4		108	199
bowfin	*Amia calva*	**4**		2			2				
brassy minnow	*Hybognathus hankinsoni*	**8**		8							
bridle shiner	*Notropis bifrenatus*	**10**									5
brook stickleback	*Labidesthes sicculus*	**22**		3						19	
brown bullhead	*Ameiurus nebulosus*	**55**	5	17	9	2	1	1			
central mudminnow	*Umbra limi*	**2**									
common carp	*Cyprinus carpio*	**5**		2							
golden shiner	*Notemigonus crysoleucas*	**19**		8	2		1			1	
grass pickerel	*Esox americanus vermiculatus*	**2**		2							
lamprey sp.	*Petromyzontidae* sp.	**1**									
largemouth bass	*Micropterus salmoides*	**169**	2	158	1						4
longnose gar	*Lepisosteus osseus*	**2**									
mimic shiner	*Notropis volucellus*	**46**									
northern pike	*Esox lucius*	**4**		1	1						
pugnose shiner	*Notropis anogenus*	**256**		4							247
pumpkinseed	*Lepomis gibbosus*	**68**	2	24		2		1		6	4
rock bass	*Ambloplites rupestris*	**36**	2	1	3	5				1	13
smallmouth bass	*Micropterus dolomieu*	**2**	1								
spotfin shiner	*Cyprinella spiloptera*	**43**									
tessellated darter	*Etheostoma olmstedi*	**2**									
unidentified minnow	Cyprinidae	**1**									
yellow perch	*Perca flavescens*	**112**	8	41	8			1		7	3
Total		**1926**	**20**	**322**	**25**	**11**	**5**	**8**	**0**	**142**	**874**